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1 [Designing a universal keyboard using chording gloves](#)

Seongil Lee, Sang Hyuk Hong, Jae Wook Jeon

June 2002 **ACM SIGCAPH Computers and the Physically Handicapped , Proceedings of the 2003 conference on Universal usability**, Issue 73-74

Full text available: [pdf\(544.77 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

A universal input device for both text and Braille input was developed in a Glove-typed interface using all the joints of the four fingers and thumbs of both hands. The glove-typed device works as of now for input of Korean characters, numbers, and Braille characters using mode conversion. Considering the finger force and the fatigue from repeated finger motions, the input switch was made of conductible silicon ink, which is easy to apply to any type of surface, light, and enduring. The usability ...

Keywords: chording gloves, device-independence, keyboard, keymap, universal access, usability

2 [The influence of muscle groups on performance of multiple degree-of-freedom input](#)

Shumin Zhai, Paul Milgram, William Buxton

April 1996 **Proceedings of the SIGCHI conference on Human factors in computing systems: common ground**

Full text available: [pdf\(1.44 MB\)](#) [html\(42.34 KB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: 3-D interface, 6 DOF input, arm, fingers, hand, homunculus model, input devices, motor control, muscle group differences

3 [Expressing guidelines into an ergonomical styleguide for highly interactive applications](#)

François Bodart, Jean M. Vanderdonckt

April 1993 **INTERACT '93 and CHI '93 conference companion on Human factors in computing systems**


Full text available: [pdf\(210.16 KB\)](#) Additional Information: [full citation](#), [references](#), [citations](#)

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4 [A virtual reality-based exercise program for stroke rehabilitation](#) ☐

David Jack, Rares Boian, Alma Merians, Sergei V. Adamovich, Marilyn Tremaine, Michael Recce, Grigore C. Burdea, Howard Poizner

November 2000 **Proceedings of the fourth international ACM conference on Assistive technologies**

Full text available:  [pdf\(837.79 KB\)](#) Additional Information: [full citation](#), [references](#), [index terms](#)

Keywords: CyberGlove, Rutgers Master II, haptic glove, rehabilitation, stroke, virtual reality

5 [Get a grip: managing RSI at MIT](#) ☐

Mary Ellen Bushnell, M. Susan Jones


October 1994 **Proceedings of the 22nd annual ACM SIGUCCS conference on User services**

Full text available:  [pdf\(444.72 KB\)](#) Additional Information: [full citation](#), [index terms](#)

6 [A survey of design issues in spatial input](#) ☐

Ken Hinckley, Randy Pausch, John C. Goble, Neal F. Kassell

November 1994 **Proceedings of the 7th annual ACM symposium on User interface software and technology**

Full text available:  [pdf\(1.20 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


We present a survey of design issues for developing effective free-space three-dimensional (3D) user interfaces. Our survey is based upon previous work in 3D interaction, our experience in developing free-space interfaces, and our informal observations of test users. We illustrate our design issues using examples drawn from instances of 3D interfaces. For example, our first issue suggests that users have difficulty understanding three-dimensional space. We offer a set of strategies ...

Keywords: 3D interaction, ergonomics of virtual manipulation, haptic input, spatial input, two-handed input, virtual reality

7 [Deneb/ERGO: a simulation based human factors tool](#) ☐

Narinder Nayar

December 1995 **Proceedings of the 27th conference on Winter simulation**

Full text available:  [pdf\(824.60 KB\)](#) Additional Information: [full citation](#), [index terms](#)

8 [Section 06: objects in space: ComTouch: design of a vibrotactile communication device](#) ☐

Angela Chang, Sile O'Modhrain, Rob Jacob, Eric Gunther, Hiroshi Ishii

June 2002 **Proceedings of the conference on Designing interactive systems: processes, practices, methods, and techniques**

Full text available:  [pdf\(4.16 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We describe the design of ComTouch, a device that augments remote voice communication with touch, by converting hand pressure into vibrational intensity between users in real-time. The goal of this work is to enrich inter-personal communication by complementing voice with a tactile channel. We present preliminary user studies performed on 24 people to

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observe possible uses of the tactile channel when used in conjunction with audio. By recording and examining both audio and tactile data, we found ...

Keywords: communication, haptic interpersonal, remote communication, tactile communication, tangible telepresence, tangible user interface, touch-vibration mapping, vibrotactile

9 Pervasive computing and virtual reality: Adding haptic feedback to engineering simulation

J. Shi, I. A. Oraifige, F. R. Hall

September 2003 **Proceedings of the 1st international symposium on Information and communication technologies**

Full text available:  pdf(179.40 KB) Additional Information: [full citation](#), [abstract](#), [references](#)

This paper describes the experimental work on engineering simulation using virtual reality techniques with haptic feedback. The role of haptic modality in a VR system and its potential have been investigated. In this paper, a low cost attempt to generate haptic feedback in a VR system is discussed.

10 Haptics and biometrics: TorqueBAR: an ungrounded haptic feedback device

Colin Swindells, Alex Unden, Tao Sang

November 2003 **Proceedings of the 5th international conference on Multimodal interfaces**

Full text available:  pdf(614.55 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Kinesthetic feedback is a key mechanism by which people perceive object properties during their daily tasks - particularly inertial properties. For example, transporting a glass of water without spilling, or dynamically positioning a handheld tool such as a hammer, both require inertial kinesthetic feedback. We describe a prototype for a novel ungrounded haptic feedback device, the TorqueBAR, that exploits a kinesthetic awareness of dynamic inertia to simulate complex coupled motion as both a di ...

Keywords: 1 DOF, haptic rod, input device, mobile computing, tilt controller, torque feedback, two-handed, ungrounded force feedback

11 Non-keyboard QWERTY touch typing: a portable input interface for the mobile user

Mikael Goldstein, Robert Book, Gunilla Alsiö, Silvia Tessa

May 1999 **Proceedings of the SIGCHI conference on Human factors in computing systems: the CHI is the limit**


Full text available:  pdf(1.28 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: PDA, QWERTY, Wizard-of-Oz, keyboard, language model, lexical knowledge, mobile user, portability, stylus input, syntactic knowledge, text input, touch-typing

12 Two-handed virtual manipulation

Ken Hinckley, Randy Pausch, Dennis Proffitt, Neal F. Kassell

September 1998 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 5 Issue 3

Full text available:  pdf(1.32 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We discuss a two-handed user interface designed to support three-dimensional neurosurgical

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visualization. By itself, this system is a "point design," an example of an advanced user interface technique. In this work, we argue that in order to understand why interaction techniques do or do not work, and to suggest possibilities for new techniques, it is important to move beyond point design and to introduce careful scientific measurement of human behavioral principles. In particula ...

Keywords: bimanual asymmetry, haptic input, input devices, three-dimensional interaction, two-handed interaction, virtual manipulation

13 [The partial-occlusion effect: utilizing semitransparency in 3D human-computer interaction](#)

Shumin Zhai, William Buxton, Paul Milgram

September 1996 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 3 Issue 3

Full text available:  [pdf\(6.54 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


This study investigates human performance when using semitransparent tools in interactive 3D computer graphics environments. The article briefly reviews techniques for presenting depth information and examples of applying semitransparency in computer interface design. We hypothesize that when the user moves a semitransparent surface in a 3D environment, the "partial-occlusion" effect introduced through semitransparency acts as an effective cue in target localization—an ess ...

Keywords: 3D interfaces, depth perception, partial occlusion, semitransparency, stereopsis

14 [Quantifying coordination in multiple DOF movement and its application to evaluating 6 DOF input devices](#)

Shumin Zhai, Paul Milgram

January 1998 **Proceedings of the SIGCHI conference on Human factors in computing systems**


Full text available:  [pdf\(1.03 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: 3D interfaces, 6 DOF control, coordination, evaluation methods, input devices, interaction techniques, mental rotation, motor control, rotation, virtual environments

15 [Rendering systems on clusters: Approach for software development of parallel real-time VE systems on heterogenous clusters](#)

C. Winkelholz, T. Alexander

September 2002 **Proceedings of the Fourth Eurographics Workshop on Parallel Graphics and Visualization**

Full text available:  [pdf\(546.54 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper presents our approach for the development of software for parallel real-time virtual environment systems (VE) running on heterogenous clusters of computers. This approach is based on a framework we have developed to facilitate the set-up of immersive virtual environment systems using single components coupled by an isolated local network. The framework provides parallel rendering of multiple projection screens and parallel execution of application and interaction tasks on components s ...

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16 User performance in relation to 3D input device design

Shumin Zhai

November 1998 **ACM SIGGRAPH Computer Graphics**, Volume 32 Issue 4

Full text available:  [pdf\(1.03 MB\)](#)


Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

Based mainly on a series of studies the author conducted at the University of Toronto, this article reviews the usability of various six degrees of freedom (6 DOF) input devices for 3D user interfaces. The following issues are covered in the article: the multiple aspects of input device usability (performance measures), mouse based 6 DOF interaction, mouse modifications for 3D interfaces, free-moving isotonic 6 DOF devices, desktop isometric and elastic 6 DOF devices, armature-based 6 DOF device ...

17 Systems, interactions, and macrotheory

Philip Barnard, Jon May, David Duke, David Duce

June 2000 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 7 Issue 2

Full text available:  [pdf\(1.60 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

A significant proportion of early HCI research was guided by one very clear vision: that the existing theory base in psychology and cognitive science could be developed to yield engineering tools for use in the interdisciplinary context of HCI design. While interface technologies and heuristic methods for behavioral evaluation have rapidly advanced in both capability and breadth of application, progress toward deeper theory has been modest, and some now believe it to be unnecessary. A case ...

Keywords: cognitive models, computing system models, models of interaction

18 Queries-R-Links: graphical markup for test navigation

Gene Golovchinsky, Mark Chignell

May 1993 **Proceedings of the SIGCHI conference on Human factors in computing systems**

Full text available:  [pdf\(609.83 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


In this paper we introduce a style of interaction (interactive querying) that combines features of hypertext with Boolean querying, using direct markup of text to launch queries. We describe two experiments that compare the relative ease of expressing Boolean queries as text versus a graphical equivalent. The results of these experiments show that the expression of queries in the graphical format is no more difficult than the textual equivalent. We then describe the Queries-R-Links system t ...

Keywords: hypertext, navigation, pen-based interaction, querying, text retrieval

19 Navigation as multiscale pointing: extending Fitts' model to very high precision tasks

Yves Guiard, Michel Beaudouin-Lafon, Denis Mottet

May 1999 **Proceedings of the SIGCHI conference on Human factors in computing systems: the CHI is the limit**

Full text available:  [pdf\(1.11 MB\)](#)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: Fitts' law, graphical tablet, input devices, mouse, multiscale interfaces, navigation, pointing, stylus

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20 Section 01: augmented education: A group game played in interactive virtual space: design and evaluation



Hanna Strömberg, Antti Väättänen, Veli-Pekka Rätty

June 2002 **Proceedings of the conference on Designing interactive systems: processes, practices, methods, and techniques**

Full text available: pdf(2.31 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We have designed and evaluated Nautilus -- a group game played in interactive virtual space. This was a study about new kinds of computer games with new types of user interfaces. Our aim was to reduce the boundaries between the surrounding physical space and the virtual space designed to appeal to users' senses. We utilized the iterative Human-Centred Design (HCD) approach in the study. We created a new way to experience and play computer games, where players use their natural body movements and ...

Keywords: computer games, human-centred design, shared experiences, user interface, virtual space

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